

Quantum Interference and Beyond

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Quantum Interference

The Quantum Interference Experiments as performed not too long ago using clusters of Rb atoms (New J. Phys. 21 (2019) 073040, Phys. Rev. Lett. 123, 083601) certainly confirms the quantum interference phenomenon of coherent states of macroscopic objects.

Yet, this is not its most remarkable feature.

While we have no problem imagining the "splitting" of an electron wave which might just be a real-space phenomenon, how can we imagine the "splitting" of the Rb cluster composed of (thousands of) atoms interacting (!) with each other?

The experiment is designed such that every atom is affected in the same way and the splitting is literally creating a "doppelgänger" of the the Rb cluster. (figure 1)

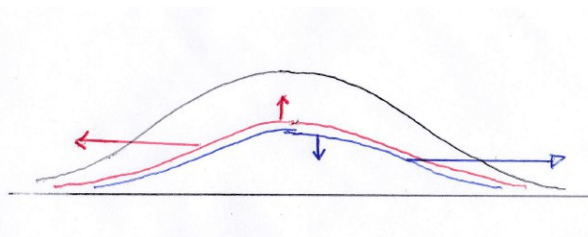


Figure 1: Rb cluster density (black), composed of spin-up (down) wavefunctions (red, blue) moving apart in opposite directions.

The question naturally arises: are the "two" clusters interacting with each other? If so, how can they split up at all? And each half-cluster, does it contain half-Rb atoms ("halbe Portionen") ?

And how does each doppelgänger interact with its surroundings? Is there even a way to complete the halbe portionen by syphoning off particles from the surroundings, thus multiplying matter in a zauberlehrling fashion?

Furthermore, these phenomena are, supposedly, not limited to Rb clusters, already complicated enough, but apply, in principle, to all matter.

Take a, rather big, molecule, easily detectable, with a valence electron that can be subjected to a Stern-Gerlach treatment and create a doppelgänger. One can put both in separate traps and investigate them.

Ordinary solid matter then seems to be entities (atoms) with completely filled Fermi states rendering them impenetrable. In this logic the halbe portionen become penetrable because their Fermi states are only partially filled. It seems that Nature has provided spin as the exclusive means to perform this splitting, in exactly equal parts. The fermionic occupation of a doppelgänger relative to the original will then be $1/2^N$ with N a positive integer.

Doppelgänger creation might be quite common microscopically (in gases) and gives a way to view (not "understand") Bragg scattering by "multiplied" atoms.

We can go further and ask, how halbe portionen of different kinds react with one another. Take, for instance, atom clusters of Rb and of Li. Split them and combine a half-cluster of Li and Rb. Will the result be some hybrid? We might assume that the number of nucleons must remain the same in order to recreate ordinary matter and one will have to adjust the stoichiometry of each half-cluster or use additional species (hydrogen?). If indeed this works, we will have found a new way of transmutation of matter: *Quantum Interference Chemistry* (QIC)

. . . and beyond

It is easy to imagine an object magically doubling itself. But it is impossible to imagine how this can work with mutual interactions.

And what one cannot imagine, cannot exist.

Simplicity is a hallmark of fundamental laws and the universality and simplicity of quantum interference leaves us no choice but to conclude that the law governing all matter field is *linear*. Apart from a possible exclusion principle (fermions), there can be no interaction, not electrodynamic, not nuclear, nor anything. All things become interference phenomena, be that solids, liquids, gases, electrons, atoms, molecules.

This abolishes the usual notion of cause and effect in the sense of force fields acting on matter. Rather, the boundary conditions determine a physical situation as a whole.

This puts us before the titanesque task to recreate bodies by pure interference. Needless to say that this will imply vast regions of space of cosmic dimensions. It gives a scientific basis to the trueism that "everything is connected" (Roger Delaforet) and puts in perspective the strange fact that Astrology is the oldest science giving rise to (ancient high precision) Astronomy.

That also means that we have to construct matter "from above" and that the microscopic world is not fundamental at all but a projection from the macrocosmos.

One might think that it would be simpler to have interaction and not need the entire universe. But this is wrong. With wave fields, localisation in space, as is observed everywhere, is impossible without an infinitely extended confining potential. So, if we need all space anyway, the law better be as simple as possible.

Which will be the equation governing all matter field?

Maybe the free Dirac equation, in operator form to account for fermionic exclusion.

There might be a mass term to give this world a scale (mass = Maß (german: measure)).

Will this be cumbersome ? Yes.

Do we have a choice ? No.